

## PATENT ABSTRACTS OF JAPAN

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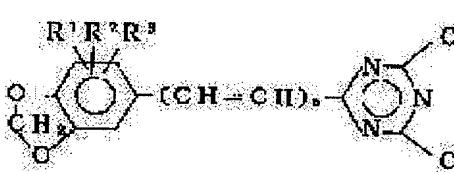
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(21)Application number : 05-101861 (71)Applicant : TOKYO OHKA KOGYO CO LTD

(22)Date of filing : 06.04.1993 (72)Inventor : SATO MITSURU  
OMORI KATSUMI  
YAMAZAKI AKIYOSHI  
IGUCHI ETSUKO

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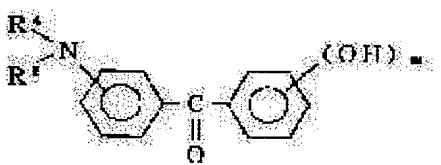
(54) NEGATIVE RADIATION SENSITIVE RESIST COMPOSITION



(57) Abstract:

PURPOSE: To attain excellent resolution, profile shape, sensitivity and to suppress influence due to the reflected light from a substrate.

I CONSTITUTION: This resist composition is made by containing an alkali soluble resin (A), an alkoxymethylated amino resin (B), a triazine compound (C) expressed by a formula I (each of R1, R2 and R3 is hydrogen atom or lower alkyl group, (n) is 0 or 1) and, if necessary, a benzophenone based compound (D) expressed by a formula II (each of R4 and R5 is hydrogen atom or lower alkyl group, (m) is 1-3).



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## \* NOTICES \*

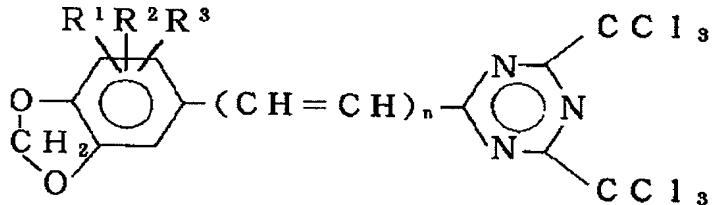
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## CLAIMS

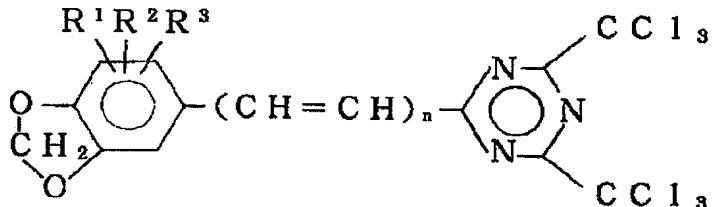
## [Claim(s)]

[Claim 1] (A) Alkali fusibility resin, (B) alkoxy methylation amino resin, and the (C) general formula [\*\* 1]

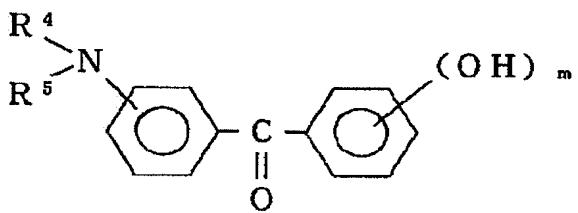


It is the feeling radiation resist constituent of a negative mold which contains the triazine compound expressed with (may differ even if they are mutually the same, and R1, R2, and R3 in a formula are a hydrogen atom or a low-grade alkyl group, respectively, and n is 0 or 1), and changes.

[Claim 2] (A) Alkali fusibility resin, (B) alkoxy methylation amino resin, the (C) general formula [\*\* 2]



They are the triazine compound expressed with (may differ even if they are mutually the same, and R1, R2, and R3 in a formula are a hydrogen atom or a low-grade alkyl group, respectively, and n is 0 or 1), and the (D) general formula [\*\* 3].



It is the feeling radiation resist constituent of a negative mold which contains the benzophenone system compound expressed with (may differ even if they are mutually the same, and R4 and R5 in a formula are a hydrogen atom or a low-grade alkyl group, respectively, and m is the integer of 1-3), and changes.

[Claim 3] The feeling radiation resist constituent of a negative mold according to claim 1 or 2 which is at least one sort as which alkali fusibility resin was chosen from novolak resin and polyhydroxy styrene resin.

[Claim 4] The feeling radiation resist constituent of a negative mold according to claim 3 whose alkali fusibility resin is polyhydroxy styrene resin.

[Claim 5] The feeling radiation resist constituent of a negative mold according to claim 4 whose polyhydroxy styrene resin is hydrogenation polyhydroxy styrene.

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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

#### [0001]

[Industrial Application] This invention relates to the new feeling radiation resist constituent of a negative mold. If it says in more detail, this invention relates to the feeling radiation resist constituent of a negative mold which is high sensitivity, and the feeling radiation resist constituent of a negative mold which can control the effect (the effect of a standing wave, notching phenomenon) by the reflected light from a substrate while having said property further, when it has high definition and being excelled in the profile configuration of a resist pattern.

#### [0002]

[Description of the Prior Art] In recent years, the advance of the densification in a semiconductor device and high integration is remarkable, and the definition in the ultra-fine processing technology is increasingly required to a submicron field. And Deep which is the ultraviolet rays of short wavelength in order to need micro processing 0.5 micrometers or less also about a lithography technique in use in the

manufacture field of a semiconductor device and to respond to this The light source which emits light in wavelength of 200–500nm, such as UV, i line, and g line, and an excimer laser (wavelength of 248nm), for example, KrF laser, are beginning to be used, and also development of the resist which induces an electron ray and X-rays is furthered.

[0003] Moreover, the research on the negative-resist constituent which suits such a radiation is also made positively. For example, Deep The constituent which consists of phenol novolak resin and a bis-azide compound as what induces UV, i line, and g line, The constituent which consists of the mixture of chloromethylation polystyrene, a polyvinyl phenol, and an aromatic series screw azide compound as what induces an excimer laser (JP,62-8777,B), an excimer laser and Deep UV and the resist constituent (JP,62-16405,A) which consists of thermosetting resin and the halogenation organic compound which absorbs the chemical rays of the wavelength range of 210–299nm as a photograph acid generator as what induces X-rays -- moreover As a resist constituent which induces an electron ray, polymethylmethacrylate (JP,45-30225,B), Polyglycidylmethacrylate [“a journal OBU electrochemical society (J. E.C.S)” The 118th volume, The resist constituent which used the 669page(1971)], chloromethylation polystyrene (JP,57-176034,A), etc. as the component is proposed.

[0004] However, it is easy to become the profile configuration where the cross-section configuration of the resist pattern obtained was [ in / these resist constituents ] roundish of SUSO, and the lengthen top was roundish, high resolution is not obtained upwards, and it is Deep. There is also a fault of not having practical sensibility to radiations, such as UV, i line, g line, an excimer laser, an electron ray, and X-rays. For this reason, in the manufacture field of a semiconductor device, it excelled in definition and the profile configuration of a resist pattern, and development of the feeling radiation resist constituent of a negative mold with high sensibility to various radiations was desired strongly.

[0005] Then, this invention persons proposed previously the negative-mold radiation induction resist constituent with high sensibility while they responded to various radiations and were excellent in the profile configuration of a resist pattern in response to such a request with high definition (JP,4-136858,A, JP,4-136859,A, JP,4-136860,A).

[0006] However, these constituents were not what may not necessarily be satisfied fully about points, such as definition, a profile configuration of a resist pattern, sensibility, and control of the effect according to the reflected light from a substrate

further.

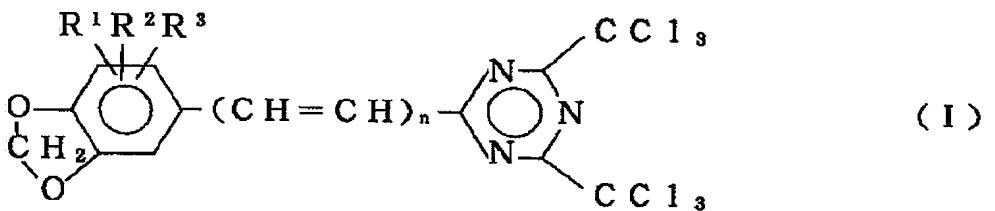
[0007]

[Problem(s) to be Solved by the Invention] This invention is the basis of such a situation, and when it has high definition and being excelled in the profile configuration of a resist pattern, it is made for the purpose of offering the feeling radiation resist constituent of a negative mold which is high sensitivity, and the feeling radiation resist constituent of a negative mold which can control the effect (effect of a standing wave, notching development) by the reflected light from a substrate while having said property further.

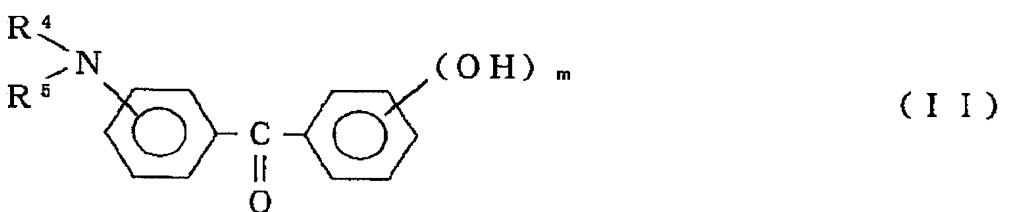
[0008]

[Means for Solving the Problem] The result of having repeated research wholeheartedly this invention persons developing the feeling radiation resist constituent of a negative mold which has the aforementioned desirable property, The constituent containing the triazine compound which has alkali fusibility resin, alkoxy methylation amino resin, and specific structure What blended the benzophenone system compound which has the outstanding high definition, gives the profile configuration of a resist pattern upwards, and has further specific structure in that sensibility is also high and said constituent found out further that the effect by the reflected light from a substrate could be controlled. This invention is completed based on this knowledge.

[0009] That is, this invention is (A) alkali fusibility resin, (B) alkoxy methylation amino resin, and the (C) general formula [\*\* 4].



It is [ the triazine compound expressed with (may differ even if they are mutually the same, and R1, R2, and R3 in a formula are a hydrogen atom or a low-grade alkyl group, respectively, and n is 0 or 1), and ] the (D) general formula [\*\* 5] by the case.



The feeling radiation resist constituent of a negative mold which contains the benzophenone system compound expressed with (may differ even if they are mutually the same, and R4 and R5 in a formula are a hydrogen atom or a low-grade alkyl group, respectively, and m is the integer of 1-3), and changes is offered.

[0010] Although there is especially no limit in this invention constituent about the alkali fusibility resin used as a (A) component, for example, the copolymer of novolak resin, acrylic resin, styrene, and an acrylic acid, polyhydroxy styrene resin, etc. are mentioned, polyhydroxy styrene resin and novolak resin are suitable in these, and since the resist pattern which is excellent in a profile configuration is obtained while the sensibility of a resist improves sharply when especially polyhydroxy styrene resin is used, it is advantageous.

[0011] The thing which made acid catalyst existence-ization carry out condensation of the aldehydes, such as formaldehyde, an acetaldehyde, a benzaldehyde, and a terephthal aldehyde, to aromatic series hydroxy compounds, such as what is commonly used as matter for coat formation, for example, a phenol, cresol, and a xylene, in the conventional positive type photoresist constituent as novolak resin is used. the weight average molecular weight into which this alkali fusibility novolak resin cut the low-molecular field -- 2000-20000 -- the thing of the range of 3000-15000 is preferably suitable.

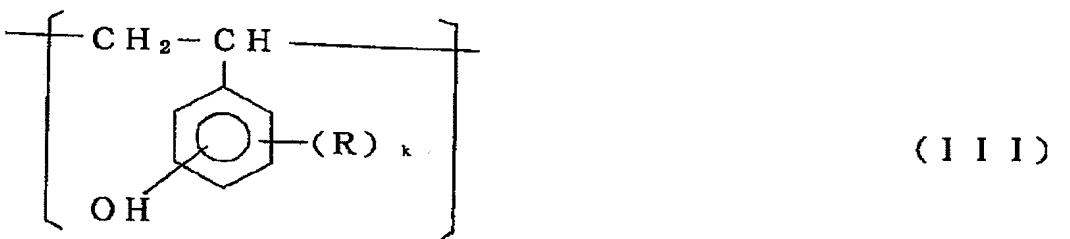
[0012] Although such alkali fusibility novolak resin is well used as a resinous principle of a resist constituent In this invention, in taking the profile configuration of a resist pattern into consideration Contain 55 - 75 % of the weight of especially m-cresol, and as what was obtained using the phenolic compound containing 30 % of the weight or more of m-cresol, and remaining components What was obtained from the mixed phenolic compound which contains 45 - 25 % of the weight per sort [ at least ] chosen from p-cresol, 2, and 5-xylene and 3,5-xylene, and changes is desirable.

[0013] On the other hand, although denaturation polyhydroxy styrene, hydrogenation polyhydroxy styrene, etc. are mentioned as polyhydroxy styrene resin, especially hydrogenation polyhydroxy styrene is suitable.

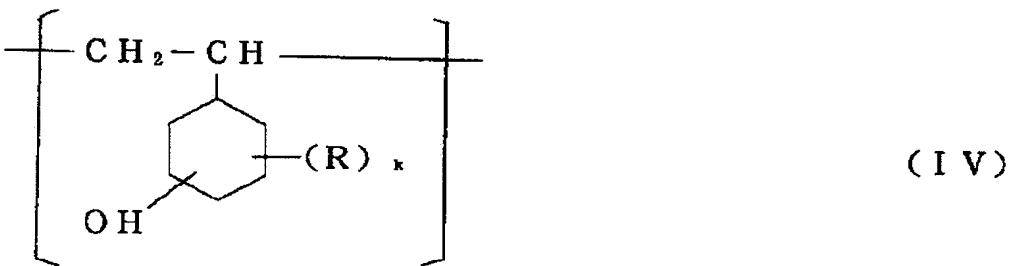
[0014] As denaturation polyhydroxy styrene, the thing which made for example, the benzenesulphonyl chloride derivative, the naphthalene sulfonyl chloride derivative, the benzene carbonyl chloride derivative, the naphthalene carbonyl chloride derivative, etc. react to polyhydroxy styrene under existence of a basic catalyst is mentioned. As an example of the aforementioned sulfonyl chloride derivative or a carbonyl chloride derivative, p-acetamino benzenesulphonyl chloride, benzenesulphonyl chloride,

p-chlorobenzene sulfonyl chloride, naphthyl benzenesulphonyl chloride, p-acetamino benzene carbonyl chloride, benzene carbonyl chloride, p-chlorobenzene carbonyl chloride, naphthyl benzene carbonyl chloride, etc. are mentioned. in this case, the polyhydroxy styrene 100 weight section -- receiving -- said sulfonyl chloride derivative and said carbonyl chloride derivative -- usually -- 10 - 30 weight section -- 15 - 25 weight section comes out comparatively preferably, and it is used. such denaturation polyhydroxy styrene -- weight average molecular weight -- 3000-50000 -- it is the thing of the range of 5000-30000 preferably.

[0015] On the other hand, hydrogenation polyhydroxy styrene is usually a general formula and [Formula 6].



It is [ the phenol system structural unit expressed with (a halogen atom, hydroxyl, a nitro group, a low-grade alkyl group or a lower alkoxy group, and k of R in a formula are the integers of 0, or 1-4), and ] a general formula [\*\* 7].



R and k in a formula mainly contain the cyclic alcohol system structural unit expressed (with the same semantics as the above), can change, and such hydrogenation polyhydroxy styrene can be manufactured by hydrogenating corresponding polyhydroxy styrene by the well-known approach. As for the rate of hydrogenation in this case, it is desirable % and that it is [ 1-40 mol ] in the 15-30-mol range of % preferably. Less than [ 1 mol % ], this rate of hydrogenation is i line and Deep. The transparency in short wavelength, such as UV field and an excimer laser, is inadequate, and if 40-mol % is exceeded, while dry etching-proof nature will fall, since the solubility over an alkali developer falls, it is not desirable.

[0016] In this invention,  $k$  is suitable for hydrogenation Pori (4-hydroxystyrene) of 0 in said general formula (III) and (IV). moreover, the weight average molecular weight (Mw) of this hydrogenation polyhydroxy styrene -- usually -- 3000-15000 -- it is preferably chosen in 5000-10000. Machine physical properties and dry etching-proof nature fall [ this weight average molecular weight ] less than by 3000, and if 15000 is exceeded, workability will fall.

[0017] Furthermore, especially the thing refined by two approaches shown below as said hydrogenation polyhydroxy styrene is suitable. After the 1st approach dissolves this hydrogenation polyhydroxy styrene in a polar solvent, subsequently to this, adds an aliphatic hydrocarbon system solvent and fully shakes, it is an approach of carrying out a slice, isolating only a polar-solvent layer preparatively, removing a solvent from this layer, and obtaining hydrogenation polyhydroxy styrene as the residue.

[0018] Under the present circumstances, as a polar solvent used, what carries out phase separation to an aliphatic hydrocarbon system solvent is mentioned, and ethyl lactate, N-methyl pyrrolidone, dimethyl imidazolidinone, dimethylacetamide, one sort of dimethylformamides, etc. may be used, and may use these combining two or more sorts, for example. The amount of this polar solvent used is good to choose so that the concentration of hydrogenation polyhydroxy styrene may usually become 1 - 50% of the weight. Moreover, as long as it is required, it may heat and this hydrogenation polyhydroxy styrene may be dissolved.

[0019] moreover, as an aliphatic hydrocarbon system solvent added to the solution obtained by doing in this way For example, a pentane, 2-methyl butane, n-hexane, 2-methyl pentane, 2 and 2-dibutyl butane, 2, 3-dibutyl butane, n-heptane, N octane, an isooctane, 2 and 2, a 3-trimethyl pentane, n-nonane, 2 and 2, a 5-trimethyl hexane, n-Deccan, n-dodecane, etc. are mentioned, and one sort of these may be used and may be used combining two or more sorts.

[0020] After the 100 - 500 weight section's coming out comparatively and usually fully shaking these aliphatic hydrocarbon system solvents to the polar-solvent 100 weight section in addition to said polar solution, it puts and separates into two-layer. The low-molecular-weight field which includes many cyclic alcohol system structural units which a polar-solvent layer separates into a lower layer, and an aliphatic hydrocarbon system solvent layer usually separates into the upper layer, and cause a residue object after resist development into the upper aliphatic hydrocarbon system solvent layer by this actuation is extracted, and contains.

[0021] By the approach of investing into poor solvents, such as a well-known approach, for example, water etc., and depositing a polymer, the method of making a

solvent distill off, etc., the polymers contained in the lower layer polar-solvent layer are collected, and are used as a binder for resists. In addition, when resist solvents, such as ethyl lactate, are used as a polar solvent, what was condensed can also be used as it is.

[0022] On the other hand, the 2nd approach is an approach of using the soluble difference to the solvent of a part including many cyclic alcohol system structural units in this hydrogenation polyhydroxy styrene, and the part which is not so, and low-grade fatty alcohol, such as methyl alcohol, ethyl alcohol, n-propyl alcohol, and isopropyl alcohol, is used in this case. One sort of these low-grade fatty alcohol may be used, and it may be used combining two or more sorts. The amount of this low-grade fatty alcohol used is usually chosen in the range of the 100 – 500 weight section to the hydrogenation polyhydroxy styrene 100 weight section.

[0023] After adding hydrogenation polyhydroxy styrene to said low-grade fatty alcohol and dissolving, it puts, but you may cool and put, after heating and dissolving in this case, if required. Since a part including many cyclic alcohol system structural units deposits by this actuation, after a well-known means removes this sludge, residual liquor is invested in poor solvents, such as water, and a polymer is deposited, it may collect and you may use as a binder for resists, or it may permute as it is and you may use for a resist solvent.

[0024] Thus, the resist constituent using the obtained purification hydrogenation polyhydroxy styrene has the high transparency in a short wavelength field, and can form a resist pattern without a residue object.

[0025] In this invention constituent, one sort of alkali fusibility resin of a \*\* (A) component may be used, and may be used combining two or more sorts.

[0026] In this invention constituent, alkoxy methylation amino resin is used as a (B) component. Especially as this alkoxy methylation amino resin, alkoxy methylation melamine resin, an alkoxy methylation urea-resin, etc. can be mentioned preferably. After making a melamine or a urea react with formalin for example, in an ebullition water solution and obtaining a condensate, these alkoxy methylation amino resin can make this able to etherify with lower alcohol, such as methyl alcohol, ethyl alcohol, propyl alcohol, and butyl alcohol, and can be prepared by taking out the resin which subsequently cools reaction mixture and deposits.

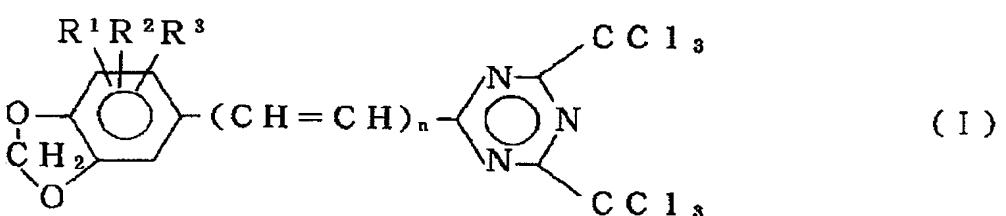
[0027] About the class of this alkoxy methylation amino resin, there is especially no limit, for example, methoxymethyl-ized melamine resin, ethoxymethyl-ized melamine resin, propoxy methylation melamine resin, butoxy methylation melamine resin, a methoxymethyl-ized urea-resin, an ethoxymethyl-ized urea-resin, a propoxy

methylation urea-resin, a butoxy methylation urea-resin, etc. are mentioned. These may be used independently and may be used combining two or more sorts.

[0028] Especially in said alkoxy methylation amino resin, the mixture of alkoxy methylation melamine resin and an alkoxy methylation urea-resin is desirable, and, as for the blending ratio of coal, it is desirable that they are the alkoxy methylation urea-resin 7 – 10 weight sections to the alkoxy methylation melamine resin 1 weight section. This alkoxy methylation melamine resin is melamine resin which was obtained by changing into an alkoxy methyl group the methylol radical of the methylol-ized melamine obtained by the conventional method, and changed the methylol radical into the or more 3.5 alkoxy methyl group preferably an average of 2.5 or more advantageously. NIKARAKKU Mx-750 marketed practically, NIKARAKKU Mx-706, NIKARAKKU Mx-101, NIKARAKKU Mx-032, NIKARAKKU Mx-708, NIKARAKKU Mx-40, NIKARAKKU Mx-31, NIKARAKKU Ms-11, NIKARAKKU Mw-22, NIKARAKKU Mw-30 (above, made in Sanwa Chemical), etc. can be used preferably. These may be independent or may be used combining two or more sorts. A commercial item like Mx-290 (made in Sanwa Chemical) as this alkoxy methylation urea-resin can be used.

[0029] As for the alkali fusibility resin of the aforementioned (A) component, and the alkoxy methylation amino resin of the (B) component, it is desirable for a weight ratio to use at 60:40 thru/or 95:5, and a rate that is preferably set to 75:25 thru/or 90:10.

[0030] It sets to this invention constituent and is a general formula [\*\* 8] as a (C) component.



It comes out and the triazine compound expressed is used.

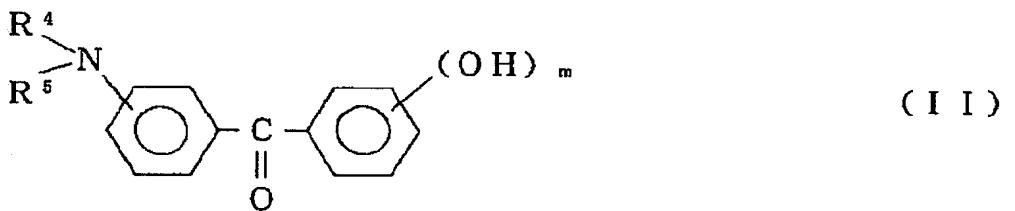
[0031] In said general formula (I), R1, R2, and R3 are low-grade alkyl groups, such as a hydrogen atom or a methyl group, and an ethyl group, respectively, and they may be mutually the same and may differ. Moreover, n is 0 or 1. This triazine compound has the structural and physical-properties-description which contains a piperonyl radical compared with the triazine compound of a publication in JP,2-146044,A used conventionally, JP,2-217855,A, JP,4-136858,A, and JP,4-136859,A, and, for this reason, can raise the sensibility of a resist constituent sharply.

[0032] Although which thing may be used as long as it has the structure expressed

with a general formula (I) as this triazine compound, that especially both R1, R2, and R3 are a hydrogen atom is suitable. [ whose ]

[0033] this invention -- setting -- the triazine compound of a \*\* (C) component -- one sort -- you may use -- two or more sorts -- combining -- you may use -- moreover, the loadings -- the total quantity 100 weight section of the aforementioned (A) component and the (B) component -- receiving -- usually -- 0.5 – 15 weight section -- it is preferably chosen in the range of 1 – 10 weight section. In under the 0.5 weight section, since the solubility over the alkali water solution of a resist will worsen and development nature will fall if crosslinking reaction does not advance enough, a desired pattern is not obtained and 15 weight sections are exceeded, these loadings are not desirable.

[0034] In addition to the aforementioned (A) component, the (B) component, and the (C) component, the need is accepted in this invention constituent, and it is a general formula [\*\* 9] as a (D) component.



It can come out and the benzophenone system compound expressed can be blended.

[0035] In said general formula (II), R4 and R5 are low-grade alkyl groups, such as a hydrogen atom or a methyl group, and an ethyl group, respectively, and they may be mutually the same and may differ. Moreover, m is the integer of 1–3.

[0036] Without spoiling resist properties, such as definition, a profile configuration of a resist pattern, and sensibility, in using a high reflective substrate like the substrate with which the substrate metallurgy by which aluminum was vapor-deposited was vapor-deposited on a silicon wafer, especially the resist constituent that blended such a benzophenone system compound can control the reflected light, can control the standing wave effectiveness, and can also control a notching phenomenon.

[0037] As a benzophenone system compound expressed with said general formula (II) For example, a 4-amino-2'-hydroxy benzophenone, a 4-amino-4'-hydroxy benzophenone, A 4-amino-6'-hydroxy benzophenone, a 4-dimethylamino-2'-hydroxy benzophenone, A 4-dimethylamino-4'-hydroxy benzophenone, a 4-dimethylamino-6'-hydroxy benzophenone, A 2-dimethylamino-2' and 4'-dihydroxy benzophenone and 4-dimethylamino-2' and 4'-dihydroxy benzophenone, A

6-dimethylamino-2' and 4'-dihydroxy benzophenone and 2-diethylamino-2' and 4'-dihydroxy benzophenone, A 4-diethylamino-2' and 4'-dihydroxy benzophenone and 6-diethylamino-2' and 4'-dihydroxy benzophenone, A 2-dimethylamino-2', 4', and 6'-trihydroxy benzophenone and 4-dimethylamino-2', 4', and 6'-trihydroxy benzophenone and 6-dimethylamino-2', 4', and 6'-trihydroxy benzophenone etc. is mentioned. Especially a desirable thing is a 4-dimethylamino-2' and 4'-dihydroxy benzophenone in these.

[0038] this invention constituent -- setting -- the benzophenone system compound of a \*\* (D) component -- one sort -- you may use -- two or more sorts -- combining -- you may use -- moreover, the loadings -- the total quantity 100 weight section of the aforementioned (A) component and the (B) component -- receiving -- usually -- 0.1 – 10 weight section -- it is preferably chosen in the range of 1 – 5 weight section. If the depressor effect of the reflected light is not fully demonstrated under in the 0.1 weight section and these loadings exceed 10 weight sections, improvement in effectiveness will not be found considering that amount, but the inclination for preservation stability to worsen rather is seen.

[0039] this invention constituent can make additives of common use, such as a coloring agent for making the additional resin for improving the engine performance of the additive which is compatible in the range which does not spoil the purpose of this invention if needed, for example, the resist film, etc., a plasticizer, a stabilizer, a surfactant, and the developed image much more in visible, and a sensitizer for raising the sensitization effectiveness more, a color for antihalation, contain.

[0040] As for this invention constituent, it is advantageous to dissolve in an organic solvent and to use said each component in the form of a solution.

[0041] As such an organic solvent, for example An acetone, a methyl ethyl ketone, A cyclohexanone, isobutyl methyl ketone, isoamyl methyl ketone, Ketones, such as a 1, 1, and 1-trimethyl acetone; Ethylene glycol, The monomethyl ether of propylene glycol, diethylene-glycol, and ethylene glycol mono-acetate or diethylene-glycol mono-acetate, The monoethyl ether, the monopropyl ether, mono-isopropyl ether, Polyhydric alcohol and the derivatives of those, such as the monobutyl ether or the monophenyl ether; Ring type ether; and methyl acetate like dioxane, Ester, such as ethyl acetate, butyl acetate, methyl lactate, ethyl lactate, methyl pyruvate, pyruvic-acid ethyl, and 3-ethoxy ethyl propionate, can be mentioned. These may be independent, or may mix and use two or more sorts again.

[0042] Next, if how to form a detailed pattern is explained using the solution of the feeling radiation resist constituent of a negative mold prepared by doing in this way On

a substrate like a silicon wafer, the solution of this resist constituent is first applied with a spinner etc. g line, i line, Deep after drying and preparing a radiation induction layer Heat-treatment is performed, after irradiating UV, an excimer laser, and X-rays alternatively through a mask, or scanning an electron ray and irradiating it.

Subsequently For example, by developing organic alkali water solutions, such as 2 – 10% of the weight of tetramethylammonium hydroxide, and a choline, using an alkali water solution, dissolution removal is carried out alternatively and the non-irradiating part of a radiation can form the resist pattern excellent in the profile configuration.

[0043]

[Effect of the Invention] When it excels in the property of resolution and a profile configuration by changing into the conventional triazine compound and using the triazine compound expressed with a general formula (I) according to this invention, sensibility can be raised sharply. Furthermore, while excelling in the property of resolution, a profile configuration, and sensibility by blending the benzophenone system compound expressed with a general formula (II), the reflected light of a high reflective substrate can be controlled and the standing wave effectiveness and a notching phenomenon (deformation of the several straight-lines-like resist pattern made to form in parallel on a substrate) can be controlled.

[0044]

[Example] Next, although an example explains this invention to a detail further, this invention is not limited at all by these examples.

[0045] In addition, the physical properties of the feeling radiation resist constituent of a negative mold were searched for as follows.

(1) Sensibility : the resist layer of 1.50-micrometer thickness was formed by applying a sample on a silicon wafer using a spinner, and drying for 90 seconds at 70 degrees C on a hot plate. Subsequently, after exposing i line alternatively at intervals of 10 to every 5 morems using contraction projection aligner NSR1755for i lines i7B [NA=0.54] (NIKON CORP. make), heat-treatment was performed for 90 seconds at 90 degrees C. Subsequently, paddle development was carried out for 65 seconds using the tetramethylammonium hydroxide water solution 2.38% of the weight, for 30 seconds, after rinsing, it dried and the resist pattern was obtained. The minimum exposure time taken to obtain the pattern dimension of 0.6 micrometers in that case was made into sensibility.

[0046] (2) Resolution : it considered as the minimum resist pattern size resolved when it exposes with the light exposure made into the above-mentioned sensibility.

[0047] (3) Profile configuration : the resist layer of 1.50-micrometer thickness was

formed by applying a sample on a silicon wafer using a spinner, and drying for 90 seconds at 70 degrees C on a hot plate. Subsequently, after exposing i line alternatively at intervals of 10 to every 5 morems using contraction projection aligner NSR1755 for i lines i7B [NA=0.54] (NIKON CORP. make), heat-treatment was performed for 90 seconds at 90 degrees C. Subsequently, paddle development was carried out for 65 seconds using the tetramethylammonium hydroxide water solution 2.38% of the weight, for 30 seconds, after rinsing, it dried and the resist pattern was obtained. What serves as O that from which the resist pattern serves as a rectangle by observation of the SEM (scanning electron microscope) photograph with which 0.6-micrometer Rhine in that case and the resist pattern of a tooth space were obtained, and serves as the shape of O and an inverse tapered shape in what serves as a rectangle mostly was made into x.

[0048] (4) The standing wave effectiveness : that in which there was no wave-like irregularity in the side face of a resist pattern, that by which the effectiveness of a standing wave is controlled was made into O, wave-like irregularity appeared in the side face of a resist pattern, and the effectiveness of constant \*\*\*\* has shown up by observation of the SEM (scanning electron microscope) photograph of the resist pattern of 0.6-micrometer Rhine obtained on the same conditions as the above (3) and a tooth space was made into x.

[0049] (5) Notching phenomenon : the several straight-lines-like resist pattern made to form in the parallel on the flat surface of a sample was observed by SEM (scanning electron microscope), and the case where distortion was produced for what deformation is not accepted in in O and each straight line was made into x.

[0050] After dissolving mull Chinese quince car PHM-C rate [% and weight average molecular weight 8000] (Maruzen Petrochemical Co., Ltd. make) of hydrogenation 50g which is example of reference 1 hydrogenation polyhydroxy styrene in 150g of ethyl lactates, putting this thing into a separating funnel, adding n-hexane 150g subsequently and shaking, it was made to separate into n-hexane layer (upper layer) and an ethyl lactate layer (lower layer) by putting. [ of 20 mols ] Subsequently, by dropping the ethyl lactate layer which removed the upper n-hexane layer, added n-hexane 150g to the ethyl lactate layer which remained, repeated the same actuation 3 times, and was obtained at 2l. pure water, the product which deposited was extracted, this was rinsed with pure water, it dried and purification hydrogenation polyhydroxy styrene was obtained.

[0051] After dissolving in methyl alcohol 200g and often shaking mull Chinese quince car PHM-C rate [% and weight average molecular weight 8000] (Maruzen

Petrochemical Co., Ltd. make) of hydrogenation 50g which is example of reference 2 hydrogenation polyhydroxy styrene, by dropping the filtrate filtered and obtained at 2l. pure water, the product which deposited was extracted, this was rinsed with pure water, it dried and purification hydrogenation polyhydroxy styrene was obtained. [ of 20 mols ]

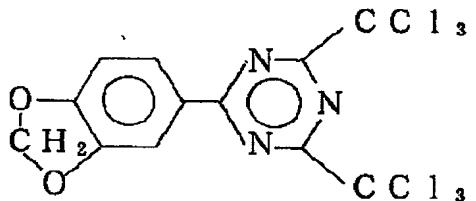
[0052] 70:30 came out of 3m-cresol of examples of reference, and p-cresol comparatively by the weight ratio, it mixed, formalin was added to this, judgment processing was performed to the cresol novolak resin which condensed with the conventional method and was obtained using the oxalic acid catalyst, the low-molecular field was cut, and the cresol novolak resin of weight average molecular weight 6000 was obtained.

[0053] It was dropped having covered [ which dissolved and obtained triethylamine 12.66g to dimethylacetamide 40g ] it for 30 minutes stirring at a room temperature, after dissolving linker M(Maruzen Petrochemical Co., Ltd. make)100g and p-acetamino benzenesulphonyl chloride 20g in dimethylacetamide 500g as example of reference 4 Pori (4-hydroxystyrene). Then, it was made to react for 5 hours, stirring at a room temperature further. Subsequently, the generation salt which deposited in the reaction solution was removed the \*\* exception, the product which deposited by dropping a filtrate at 5l. cold water was extracted, and the denaturation polyhydroxy styrene which rinses this and is made into the purpose by drying was obtained.

[0054] After dissolving purification hydrogenation polyhydroxy styrene 8.0g obtained in the example 1 of example 1 reference, Mx-290 (made in Sanwa Chemical) 1.80g which is a methoxymethyl-ized urea-resin, and Mx-750 (made in Sanwa Chemical) 0.20g which is methoxymethyl-ized melamine resin in 32g of ethyl lactates, 2.5g was dissolved for the following triazine compound, and the resist solution was obtained.

[0055]

[Formula 10]



[0056] Next, the spin coat was carried out for 20 seconds by 4000rpm on the 6 inch silicon wafer which left this resist solution for 7 minutes, and carried out surface preparation into the hexamethyldisilazane ambient atmosphere, and the physical

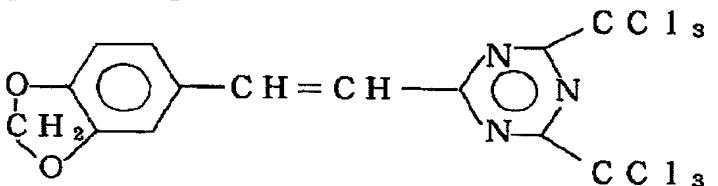
properties of sensibility, resolution, and a profile configuration were searched for by the approach mentioned above. This result is shown in Table 1.

[0057] The resist solution was obtained like the example 1 except having changed purification hydrogenation polyhydroxy styrene into the resin obtained in the example 2 of reference, the example 3 of reference, or the example 4 of reference in two to example 4 example 1. And the physical properties of the resolution of a resist pattern, sensibility, and a profile configuration were searched for by the same approach as an example 1. The result is shown in Table 1.

[0058] The resist solution was obtained like the example 1 except having changed the triazine compound into the following triazine compound in example 5 example 1. And the physical properties of the resolution of a resist pattern, sensibility, and a profile configuration were searched for by the same approach as an example 1. The result is shown in Table 1.

[0059]

[Formula 11]



[0060] The resist solution was obtained like the example 5 except having changed purification hydrogenation polyhydroxy styrene into the resin obtained in the example 2 of reference, the example 3 of reference, or the example 4 of reference in six to example 8 example 5. And the physical properties of the resolution of a resist pattern, sensibility, and a profile configuration were searched for by the same approach as an example 5. The result is shown in Table 1.

[0061] The resist solution was obtained like the example 1 except having changed the triazine compound into 2-(p-methoxyphenyl)-4 and 6-bis(trichloromethyl)-1,3,5-triazine in example of comparison 1 example 1. And the physical properties of the resolution of a resist pattern, sensibility, and a profile configuration were searched for by the same approach as an example 1. The result is shown in Table 1.

[0062]

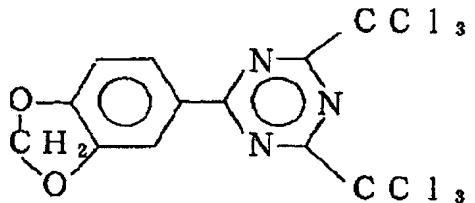
[Table 1]

	アルカリ可溶性樹脂	アルコキシメチル化アミノ樹脂の種類と配合比	レジスト特性		
			感度 m s	解像度 μm	プロファイル形状
実施例 1	参考例 1	Mx-290/Mx-750 (9/1)	160	0. 40	◎
実施例 2	参考例 2	Mx-290/Mx-750 (9/1)	150	0. 40	◎
実施例 3	参考例 3	Mx-290/Mx-750 (9/1)	210	0. 50	○
実施例 4	参考例 4	Mx-290/Mx-750 (9/1)	160	0. 45	◎
実施例 5	参考例 1	Mx-290/Mx-750 (9/1)	170	0. 40	◎
実施例 6	参考例 2	Mx-290/Mx-750 (9/1)	160	0. 40	◎
実施例 7	参考例 3	Mx-290/Mx-750 (9/1)	230	0. 50	○
実施例 8	参考例 4	Mx-290/Mx-750 (9/1)	170	0. 45	◎
比較例 1	参考例 1	Mx-290/Mx-750 (9/1)	300	0. 45	×

[0063] After dissolving purification hydrogenation polyhydroxy styrene 8.0g [ which was obtained in the example 1 of example 9 reference ], Mx-290 (made in Sanwa Chemical) 1.80g [ which is a methoxymethyl-ized urea-resin ], Mx-750 (made in Sanwa Chemical) 0.20g [ which is methoxymethyl-ized melamine resin ] and 4-dimethylamino-2', and 4'-dihydroxy benzophenone 2g in 32g of ethyl lactates, 2.5g was dissolved for the following triazine compound, and the resist solution was obtained.

[0064]

[Formula 12]



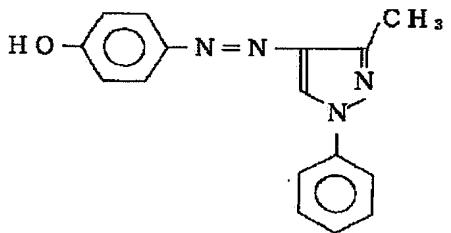
[0065] Next, the spin coat of this resist solution was carried out for 20 seconds by 4000rpm on the 6 inch silicon wafer which vapor-deposited gold, and the physical properties of sensibility, resolution, a profile configuration, the constant \*\*\* effectiveness, and a notching phenomenon were searched for by the approach mentioned above. This result is shown in Table 2.

[0066] The resist solution was obtained like the example 9 except having changed the 4-dimethylamino-2' and 4'-dihydroxy benzophenone into the compound expressed with other general formulas (II) in ten to example 12 example 9. And the physical properties of the resolution of a resist pattern, sensibility, a profile configuration, the standing wave effectiveness, and a notching phenomenon were searched for by the same approach as an example 9. The result is shown in Table 2.

[0067] In example of comparison 2 example 9, the resist solution was obtained like the example 9 except having changed the 4-dimethylamino-2' and 4'-dihydroxy benzophenone into the following compound. And the physical properties of the resolution of a resist pattern, sensibility, a profile configuration, the standing wave effectiveness, and a notching phenomenon were searched for by the same approach as an example 9. The result is shown in Table 2.

[0068]

[Formula 13]



[0069]

[Table 2]

	アルカリ可溶性樹脂	アルコキシメチル化アミノ樹脂の種類と配合比	一般式(II)の化合物	レジスト特性				
				感度 m s	解像度 μ m	プロファイル 形状	定在波 効果	ノッチング現象
実施例9	参考例1	Mx-290/Mx-750(9/1)	AHBP1	220	0.45	◎	○	○
実施例10	参考例1	Mx-290/Mx-750(9/1)	AHBP2	230	0.45	◎	○	○
実施例11	参考例1	Mx-290/Mx-750(9/1)	AHBP3	260	0.45	◎	○	○
実施例12	参考例1	Mx-290/Mx-750(9/1)	AHBP4	200	0.45	◎	○	○
比較例2	参考例1	Mx-290/Mx-750(9/1)	—	300	0.50	×	×	×

(注) AHBP1 : 4 - ジメチルアミノ - 2' , 4' - ジヒドロキシベンゾフェノン  
AHBP2 : 4 - アミノ - 4' - ヒドロキシベンゾフェノン  
AHBP3 : 4 - ジエチルアミノ - 2' , 4' - ジヒドロキシベンゾフェノン  
AHBP4 : 4 - ジメチルアミノ - 2' , 4' , 6' - トリヒドロキシベンゾフェノン

[Translation done.]